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Propellants

3 August 1954

JU 9-7700

Mr. P. A. Reilly, Jr.
Solid Propellant Information Agency,
The Johns Hopkins University, Applied Physics Laboratory
8421 Georgia Avenue
Silver Spring, Maryland

Dear Mr. Reilly:

Enclosed are two copies of a draft transcript of the presentations made by you and your colleagues on 14 June at the Propellants Seminar conducted by the IDIC Working Group on Propellants and Fuel Additives in Washington at that time. Will you please review them for accuracy and completeness? I am sorry to say that the recording failed at some points and that, at others, we were unable to understand all that was being said. We have checked what we could with your survey on "Solid Propellants", but when your talks deviated from the survey statements, we have put down what we heard, even when it did not appear to be correct, thinking that the sounds we transcribed might help you to remember the correct words. Inasmuch as there continues to be a special interest in boron and its significance as a component of propellants, you may wish to review the sections dealing with this commodity with particular care.

You will notice that, other than a preliminary division of the material into sentences and paragraphs and the insertion of commas where the speaker appeared to pause for that reason, we have not attempted to edit the transcript. Any suggestions you have about the form of presentation will be appreciated. However, if you find it easier to pay attention only to factual accuracy, we shall be glad to take care of the editing when you return the corrected draft to us.

In cases where the material that you presented at the Seminar is not included in your survey, will you please furnish us with source references, where appropriate; with the security classification of the information; and with copies of the data, in the case of slides?

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Would it be possible for you to supply us with about ten or twenty additional copies of your survey, "Solid Propellants", for distribution to people who failed to pick up copies for themselves at the 14 June meeting or who were unable to attend the meeting. We have had several such requests for copies.

After the Seminar, Mr. J. S. Magnusson, of the Bureau of Foreign Commerce in the US Department of Commerce, submitted the following questions for your consideration:

Subject: Nitrocellulose - In an emergency does cellulose acetate serve as a useful raw material for production of cellulose nitrate of 12.5 N and greater?

Can commercial raw materials, as film scrap and lacquer chips be reprocessed to yield a useful cellulose nitrate for munitions (e.g. above 12.5 N for rockets)?

You may answer him directly, if you wish, or, if you prefer to send your comments to us, we shall be glad to forward them to him promptly.

Sincerely,

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Secretary, EMEC Working Group on Propellants and Fuel Additives

Enclosures:

Original and one carbon of the EMEC Working Group on Propellants and Fuel Additives, Propellants Seminar, 13-14 June 1956, "Transcript," 14 June, pp. 1-57, Secret/NOFORN.

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MEMO ROUTING SLIP		NEVER USE FOR APPROVALS, DISAPPROVALS, CONCURRENCES, OR SEVERAL	
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[REDACTED] 25X1A9a			
<p>The transcript looks very complete except for significant omissions on <u>Page 8</u>. I have tried to fill in missing data from my notes.</p> <p>I am sorry my comments are hand-written, but I could not get them typed on short notice.</p> <p>Thanks very much for the loan of the transcript. Please call me if I can be of any assistance.</p>			
FROM NAME OR TITLE E. S. Finegold		DATE 8/31/56	
ORGANIZATION AND LOCATION AFICIN-3A262		TELEPHONE 63957	

DD FORM 1 FEB 50 95

Replaces DA AGO Form 895, 1 Apr 48, and AFHQ Form 12, 10 Nov 47, which may be used.

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EDIC Working Group - Propellants Seminar13 June 1956CORRECTIONS AND OMISSIONS

Page 5, line 19

"device" should read "device"

Page 8, top

Last part of Mr. Fillbert's remarks is omitted. He cited some cost figures for US rocket propellants for surface-to-air, air-to-air, and surface-to-surface missiles following completion of his engine description. He also suggested as a valuable reference an article in Chemical Week of April 7, 1956, entitled "The Sky's No Limit", for which reprints are available.

Page 8, middle

Mr. Tamm's talk here is completely omitted. He discussed at length the concepts of specific impulse and range and their relationship. He then listed the criteria for the ideal

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Page 8 middle

propellant. These are as follows:

1. High energy (specific impulse, at least 350 seconds)
2. Boiling point greater than 90 C
3. Freezing point below minus 60 C
4. High viscosity index - i.e., only slight viscosity changes over wide temperature range
5. Density greater than 0.9 grams/cubic centimeter
6. No toxic effects
7. Noncorrosiveness to standard materials of construction
8. Low cost
9. Ease of ignition with common oxidizers or fuels
10. Insensitiveness to mechanical and thermal shock

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11. Low vapor pressure
12. Suitability as a regenerative coolant
13. Nonluminous exhaust products.

Page 8 bottom

Mr. Bowman's introductory remarks are omitted. He discussed the ~~ideal~~ criteria for the ideal monopropellant, which are similar to those for a liquid bi-propellant. He then listed the following monopropellants as of ^{greatest} interest:

1. 90% hydrogen peroxide
2. Ethylene oxide
3. N-Propyl nitrate and its mixture with ethyl nitrate
4. Nitromethane
5. Methyl acetylene
6. Hydrazine
7. "Penelope" (40.7% pyridinium nitrate and 59.3% WFNA).

He then began a discussion of each of these in turn. The first to be considered was 90% hydrogen peroxide.

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^{40%}
Of hydrogen peroxide, he said the problem is in the freezing point (12°F). It has a high density (1.39), which is good. It has a specific impulse of 132 and a density impulse of 190. Its use at 70-76% H_2O_2 in gas generators in larger missiles was discussed. He pointed out the various catalysts that can be used with H_2O_2 . The Germans used potassium permanganate. Other catalysts are available. 99.6 aluminum is recommended for storage and transfer as well as polyethylene steel-braided lines. For clothing, dacron and polyethylene can be used. Equipment must be clean. It is troublesome to handle and expensive. The US Navy is interested in concentrated H_2O_2 because acids are no good on shipboard. The Navy is interested in H_2O_2 both as a ~~monopropellant~~ monopropellant and as an oxidizer in bi-propellants. There is some fire hazard and danger of skin burns as well as a possible decomposition build-up resulting

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in explosions. If equipment is meticulously clean, it is quite stable. It becomes a problem at above - 100°F. Stabilizers are used. It is produced by

1) electrolytic process - 35% H_2O_2 distilled to 90%. It is expensive (high power cost and high purity of product)

2) Non-electrolytic

a. Dupont - decomposition of anthraquinone

b. Shell - petroleum process from isopropyl alcohol

See Buffalo Electrochemical Co.

works for Butler, M. I. T. Lab, and Dupont, Shell, Columbia Southern. It costs 54¢ a pound.

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Mr. Bowman then discussed ETHYLENE OXIDE. This material has a density of 0.9 and boiling point of 51°F. It is, like kerosene, safe to handle. Flames must be avoided. It is handled in steel or aluminum, with no

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corrosion. Acids, bases, oxides, and chlorides tend to polymerize it and should be avoided. It is produced from

- 1) ethylene - old method
- 2) direct ~~oxidation~~ oxidation with silver catalyst, a new method.

Six U.S. companies produce it (See Wyandotte Chemical Co.). It has a specific impulse of 159 to 161 seconds and is readily available.

Mr. Bowman then took up N-Propyl Nitrate and its mixture with ethyl nitrate. The transcript is correct from here on.

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~~completely omitted. The third
monopropellant he discussed was
propyl nitrate and its mixture
with ethyl nitrate. Only the
first sentence of this section is
omitted. The transcript then
takes over.~~

- Page 12 line 16 "Methoacetylene" should read
"Methyl Acetylene", I believe.
- Page 13 line 8 "Ammine" should read "Amine".
- Page 15 line 9 "Hydrogen tetroxide" should read
"Nitrogen tetroxide".
- Page 19 line 21 "Stroage" should read "storage".
- Page 22 line 14 "Wehn" should read "when"
- Page 27 line 8 "Fluorine trifluoride" should read "chlorine trifluoride"
- Page 34 line 8. I believe he stated the specific
impulse of VP 4 with liquid
oxygen is 265.
- Page 34 line 15 "Netronitromethane" should read
"tetranitromethane".

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Page 37, bottom

My notes indicate nothing significant was lost by the broken tape here.

Page 41, top

My notes indicate nothing significant was lost by the broken tape here.

Page 49 bottom

I don't have the cost figure which is omitted. Nothing else significant is omitted here.

Page 57 line 9

"Armeys" should read "Army's"

Page 57 line 12

"Lar" should read "Lark".

Page 57 line 21

Am not familiar with the "Nalai". Is this spelled correctly?

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